Bay was considerably smaller than its earlier stage. The Sunderland terrace was formed at this time. The shore line of the Sunderland terrace follows the bluff north of Florida Avenue between Eleventh Street and Connecticut Avenue.

During the Illinoian glacial stage the seas were again depleted and tidal waters drained away down the Pliocene course of the Potomac. When the ice had melted during the Sangamon interglacial stage, tides rose only about 95 feet above present sea level and extended up the Potomac only to the foot of Great Falls. Down-town Washington was again under water and Potomac Bay was not greatly altered. The terrace corresponding to the 95-foot stage is the Wicomico. Capitol Hill is an outlier of the Wicomico, and Dupont Circle, Scott Circle, Thomas Circle, and Iowa Circle are on the same terrace.

After the low water of the Iowan glacial stage, the water rose in Peorian time to an altitude of only 65 feet. Tides extended to the head of Stubblefield Falls and up the Eastern Branch to Berwyn. Capitol Hill made an island in Potomac Bay. The Chowan terrace was formed at this time. F and G streets, Lafayette Square, and Union Station Plaza are on the Chowan terrace.

Sea level fell in early Wisconsin time, but during the inter-Wisconsin retreat of the ice it rose again to an altitude of about 25 feet. At this time the Pamlico terrace was formed. Tides were stopped by Little Falls. Pennsylvania Avenue between Peace Monument and Fifteenth Street was flooded, and most of Southwest Washington except an island at the Department of Agriculture site was under water.

Late Wisconsin glaciation again lowered sea level, but at the beginning of the Recent epoch the water attained its present stage. Tides now extend to Little Falls and up the Eastern Branch to Bladensburg.

Summary

The important conclusions of this paper are as follows:

The shore lines of the six Pleistocene terraces are horizontal as far as they have been traced. Horizontal terraces at the same altitudes have been noted in France and in South Africa. The shore lines are therefore interpreted as high-water marks made by a fluctuating sea upon stationary continents rather than as marks of a stationary sea made upon oscillating continents.

Glacial control of sea level is regarded as the dominant cause of the fluctuations of sea level during the Pleistocene epoch. Sea level was high during interglacial stages and low during glacial stages. The

shore lines of the terraces therefore represent the high-water marks of the preglacial and interglacial stages.

The warping of the continent which brought about the unequal drowning of the Atlantic coast deformed Pliocene deposits but did not deform Pleistocene shore lines. It is therefore regarded as the closing episode of Pliocene time.

BIOLOGY.—*The interrelation of Foraminifera and Algae.*[1] JOSEPH A. CUSHMAN, Sharon, Massachusetts.

The relationship of the Foraminifera and Algae has already been noted.[2] It has been well known for some time, too, that there is an association of Algae with Corals. In tropical, warm, shallow waters, such as give the right conditions for the development of coral reefs, there are found several groups of larger Foraminifera. For the most part these are limited to such conditions, and are known only from the tropics, most of them from the Indo-Pacific. These include particularly the families Camerinidae, Peneropliidae, and Alveolinellidae. Just what the relationship is between the two forms of the Foraminifera and the Algae is not yet clear. It may be due to food relations, or to the development of oxygen by the Algae. That the relationship is a very definite one is shown by the fact that distribution of these larger Foraminifera is limited to a depth of about 30 fathoms. This depth is approximately that to which Algae are limited by the amount of sunlight that penetrates the sea-water. It is probable that when the relationships between Algae and Corals are fully known the same factors will apply to the Algae and the Foraminifera.

In the fossil series larger Foraminifera of the families already mentioned and those belonging to the extinct group of the Orbitoids are very prominent from the later Cretaceous, and representatives of the earlier groups except the Orbitoids are still living under the conditions already noted. A map of the distribution of the Orbitoids, for example, in the Eocene will show that they are very largely limited to areas which at that time from the occurrence of Corals and other forms are known to have been warm shallow areas. During this period great masses of limestone many thousands of feet thick were developed across the tropical regions of the world in large part built

[1] Received June 23, 1930.

[2] CUSHMAN, *Shallow water Foraminifera of the Tortugas Region,* Publication Carnegie Institution, Washington, **311**: 10. 1922; *Observation on living specimens of* Iridia diaphana, *a species of Foraminifera,* Proc. U. S. Nat. Mus. **57**: 154, 1920.

up of such Foraminifera. These same areas parallel very closely the distribution of Tertiary oil fields, and it is at least suggestive that there may be a relationship between the two.

This relationship of the Algae and the Foraminifera might well furnish an interesting problem for research, either from an economic or purely scientific point of view. So far as observations have been made, both green and brown Algae can assume this relationship with the Foraminifera, usually unicellular forms showing this relationship. These often give a definite color to the living Foraminifera which is not seen at all in the dried material.

BOTANY.—*A new cannon-ball tree from Panama.*[1] By C. V. MORTON, National Museum. (Communicated by WILLIAM R. MAXON).

Included among the plants of a recent collection made by Dr. A. F. Skutch in the vicinity of Almirante, Panama, and generously presented by him to the U. S. National Museum is a specimen of cannon-ball tree (*Couroupita*), which critical study shows to represent a new species, as suspected by Doctor Skutch in the field. It is described herewith, the specific name being in honor of Mr. Victor M. Cutter, President of the United Fruit Company, in recognition of generous support of many projects relating to tropical American botany.

Couroupita cutteri Morton & Skutch, sp. nov.

Very tall tree with widely spreading branches; branchlets glabrous, conspicuously marked with leaf scars; leaves clustered at the ends of the branchlets, alternate, nonpunctate, deciduous at flowering time; petiole short, about 10–12 mm. long, pubescent; lamina oblanceolate, 13–21 cm. long, very obtuse at apex, cuneate at base, minutely denticulate, glabrous, except in the axils of the veins beneath; secondary veins 16–18, conspicuously raised beneath; inflorescence paniculate, arising from the trunk and main branches, up to 50 cm. long; calyx of 6 sepals, 6 mm. long, 7.5 mm. broad, broadly rounded at apex, fleshy, thinner at margin, ciliolate; petals oblong, very fleshy, 4–4.5 cm. long, 3–3.5 cm. broad, greenish white outside, cream color within, ciliolate; androphore cream color, basal ring 17–18 mm. in diameter, the ring and the inner surface of the hood completely covered with fertile stamens; filaments of the basal ring clavate, 1 mm. long, those of the hood more elongate (about 3.5 mm.); anther cells divaricate at base; ovary 6-celled, fruit not seen.

Type in the U. S. National Herbarium, no. 1,409,624, collected in a pasture near base line, 15 miles from Almirante, Panama, in May, 1929, by A. F. Skutch (no. 19). Alcoholic specimens of the flowers are also preserved.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received June 16, 1930.